

REMARKS/ARGUMENTS

Claims 1-12, 14-18 and 23-28 were pending in this application. Claims 2 and 26-28 have been amended. Claims 13 and 19-22 are cancelled herein. Claims 29-38 are added. Accordingly, Claims 1-12, 14-18, and 23-38 are currently pending in the application.

Claim Rejections under 35 U.S.C. 112:

Claims 1 and 25-28 have been rejected under 35 U.S.C. 112, first and second paragraphs, as being unpatentable for being non-enabling, indefinite, and otherwise failing to comply with the written description requirement. Applicants traverse these rejections as discussed below. The Applicants, of course, point out that selective photo-ionization of metal and/or metal salts is described at paragraphs [0026]-[0029], for example. This much is correctly acknowledged by the Examiner in the pending action. The Examiner has argued that the Specification does not support "selectively ionizing the vaporized metallic element or salt to generate a plasma" as recited in Claim 1. This conclusion would fly directly in the face of the teachings of the cited portions of the specification and in the face of the knowledge of a person having ordinary skill in the art. As an example of knowledge of the state of the art, one can make reference to, for example, "Ion Beams: With Applications to Ion Implantation" by Robert G. Wilson and George R. Brewer, (Reprint Edition published by Robert Krieger Publishing originally in 1979). A chapter entitled, "Ionization Phenomena" (particularly at page 39) is especially relevant. The relationship wavelength is defined by a constant (12398) divided by ionization energy E (in units of eV) for the material ionized (hence, $\lambda = 12398/EE(\text{eV})$). Carrier gasses such as He, Ne, Ar are listed as having ionization potentials and effective ionization exposure wavelengths of, respectively, He: 24.58 eV and 502Å, Ne: 21.56 eV and 573Å, and for Ar: 15.75 eV and 784Å. This is to be contrasted with, for example, ionization potentials and threshold wavelengths for Ca: 6.11 eV and 2020Å, Sr: 5.70 eV and 2168Å, and for Mn: 7.44 eV and 1660Å. It should be pointed out that many other reference sources known to those having ordinary skill in the art could have been cited in addition to the previously referenced source.

These few examples are provided to share with the Examiner a deeper understanding of the general state of knowledge available to a person having ordinary skill in the art. From the few examples above, it should be noted that at some wavelengths photo exposure will selectively

ionize the metallic atoms while not ionizing the carrier gas, precisely the effect claimed and supported by the pending application.

Accordingly, the Applicants respectfully submit that the specification has provided a few representative examples of selectively ionizing a material to be deposited (while not ionizing the carrier gas). It is not required to, and is in fact impossible to, provide a detailed listing of all possible material carrier gas combinations and ionization parameters available to all. The invention is intended to cover all such combinations and has provided more than sufficient disclosure enabling one of ordinary skill to practice the invention as claimed.

As to Claim 25, Applicants are uncertain to the vagueness of this claim. The following is clear from the claim language selective ionization means selectively ionizing the metallic element or salt while at the same time not ionizing the carrier gas (hence the word "selectively"). This is believed to be captured by the recited language "selectively ionizing the vaporized metallic element or salt to generate a plasma comprises selectively photo-ionizing the metallic element or salt without ionizing the inert carrier gas". The Applicants respectfully submit that the recited language is clear and to the point without vagueness. To the extent clearer language is required to convey this meaning, suggestions are earnestly solicited from the Examiner.

Claim 26 is clarified and the additional operation of "generating an ion beam from the selectively ionized metallic element or salt" is claimed. This means that once the selectively ionized plasma is generated it is then used to form an ion beam. See, for example, Fig. 3 and, for example, paragraphs [0028]-[0030], [0038]-[0043] and so on.

As to Claim 27, which recites "implanting the substrate", this is a fairly straightforward application of the technology of Claim 26. Its use and applications as implantation process are discussed throughout the Specification. The concept is merely that the ionized plasma of the ion beam can be used to implant material into the substrate.

As to Claim 28, which recites "depositing a layer of the selectively ionized metallic element or salt onto a substrate", this is a fairly straightforward application of the technology. Its use and applications as a deposition process are discussed throughout the Specification. In particular, the section entitled "Deposition", at pages 12-15, is especially explanatory. The concept is merely that the ionized plasma can be used to form layers of material on the substrate.

Therefore, Applicants respectfully submit that the foregoing remarks are sufficient to traverse the pending rejections and overcome the expressed grounds under 35 U.S.C. § 112, second paragraph. Therefore, Applicants respectfully request that this ground of rejection be withdrawn as to Claims 1 and 25-28.

Claim Rejections under 35 U.S.C. 103:

The Examiner has rejected claims 2-12 and 14-18 under 35 U.S.C. 103 variously as unpatentable over *Oren et al.* (U.S. Pat. 4,742,022 hereinafter *Oren*) and *Kogal et al.* (U.S. Pat. 6,416,822 hereinafter *Kogal*). Applicants traverse these rejections as discussed below.

Rejection Oren

The Examiner has rejected all Claims 2-12 and 14-18 under 35 U.S.C. 103 as being unpatentable over *Oren*. The Applicants respectfully disagree with this contention for reasons explained below.

Fundamentally, the present invention embodies a method for heating and vaporizing a class of metal and metal salts for use in semiconductor deposition processing. This is particularly relevant to angstrom-scale processes adaptable to the formation of atomic layer thickness films (Specification at, for example, paragraph [0023],[0042],[0051] and so on). This goes far beyond the sensitivity available to a primitive and obsolete technology such as *Oren*. This distinction should now be sufficiently amplified by the language added to amended Claim 2 "depositing the vaporized metallic element ... in atomic layer thicknesses within the chamber". Such a process is not contemplated or possible with the cited art which is directed to vaporizers directed to the fabrication of large scale deposits and crystal growth rather than the fabrication of monatomic layers.

These deficiencies of the cited art become even more pronounced when applied to the dependent claims. In just one, for example, the Examiner is directed to Claim 15. The cited art does not include any teaching of a deposition of calcium onto a silicon dioxide surface. Yet the claim is rejected. There are other examples.

As is known to those having ordinary skill in the art, processing as claimed here by the Applicants is incredibly delicate and precise. This is pointed out to illustrate that the differences

between the cited art and the claimed invention are not subtle. *Oren* is yet another gross large scale deposition and crystal formation process. This is a brute force coating method where precision is of no particular concern. This is in direct contrast to the claimed invention. The Applicants refer the Examiner to paragraph [0023] (page 7) where it is pointed out that the claimed inventive deposition and vaporization techniques can be used to form layers of one atom thick!

Accordingly, one of ordinary skill in the art would not look to obsolete technology to find an atomic layer deposition technology. There is no teaching or suggestion that such a technology can even be applied to semiconductor processing with ANY expectation of success at all. Accordingly, one of ordinary skill in the art would not achieve the claimed invention using the cited art. This is in fact made quite clear in the action where no direct application of the cited art to ANY dependent claims is made. In other words, no case is made in the Action that the claimed invention is obvious in view of cited art.

However, as explained above, certain amendments are made to clear any doubt as to this issue. Claim 2 has been amended to recite "depositing the vaporized metallic element or salt on a substrate in atomic layer thicknesses within the chamber". Accordingly, the Applicants therefore respectfully request that this rejection be withdrawn as to Claim 2.

Claims 3-12 and 14-18 all depend from Claim 2, and therefore, for at least the reasons advanced in support of Claim 2, are also believed to be allowable. Additionally, each of these dependent claims is believed to be allowable for reasons further absent the cited art. However, as stated previously, due to the present allowability of these claims no further discussion of these claims is necessary at this time. The Applicants therefore respectfully request that this ground of rejection be withdrawn as to Claims 2-12 and 14-18.

Rejection Kogai

The Examiner has rejected all Claims 2-12 and 14-18 under 35 U.S.C. 103 as being unpatentable over *Kogai*. The Applicants respectfully disagree with this contention for reasons explained below.

Fundamentally, the present invention embodies a method for heating and vaporizing a class of metal and metal salts for use in semiconductor deposition processing. However, this is particularly relevant to atomic-scale processes adaptable to the formation of atomic layer

thickness films (Specification at, for example, paragraph [0023],[0042],[0051] and so on). This goes far beyond the sensitivity available to a technology such as *Kogai* which distributes particulate zinc rather than atomic layers of material. This distinction is believed to be clarified by the language added to amended Claim 2 "depositing the vaporized metallic element ... in atomic layer thicknesses within the chamber". Such a process is not contemplated or possible with the cited art which is directed to vaporizers directed to the fabrication of large scale deposits (particulates (*Kogoi* 4:50-55, 8:44-49, 8:65-67); tetrapod shaped particulates (*Kogoi* 7:24-30, 7:55-60, 8:20-27) and crystal growths rather than the Angstrom level fabrication of monatomic layers.

As explained above, these deficiencies of the cited art become even more pronounced when applied to the dependent claims. In just one, for example, the Examiner is directed to Claim 15. The cited art does not include any teaching of a deposition of calcium onto a silicon dioxide surface. Yet the claim is rejected. There are other examples.

As is known to those having ordinary skill in the art, processing as claimed here by the Applicants is incredibly delicate and precise. This is pointed out to illustrate that the differences between the cited art and the claimed invention are not subtle. *Kogoi* is yet another gross large scale deposition and crystal formation process. This is in direct contrast to the claimed invention. The Applicants refer the Examiner to paragraph [0023] (page 7) where it is pointed out that the claimed inventive deposition and vaporization techniques can be used to form layers of one atom thick!

Accordingly, one of ordinary skill in the art would not look to this prior art reference to find an atomic layer deposition technology. There is no teaching or suggestion that such a technology can even be applied to semiconductor processing with ANY expectation of success at all. Accordingly, one of ordinary skill in the art would not achieve the claimed invention using the cited art. This is in fact made quite clear in the action where no direct application of the cited art to ANY dependent claims is made. In other words no case is made in the Action that the claimed invention is obvious in view of cited art. This shortcomings of the cited art illustrate that the cited references fail to establish a prima facie case of obviousness as the Claims 2-12 and 14-18. Accordingly, the Applicants respectfully request that this ground of rejection be withdrawn as to the pending claims.

Also, as explained above, amendments have been made to clarify any lingering doubt as to this issue. Claim 2 has been amended to recite "depositing the vaporized metallic element or salt on a substrate in atomic layer thicknesses within the chamber". Accordingly, the Applicants therefore respectfully request that this rejection be withdrawn as to Claim 2.

Claims 3-12 and 14-18 all depend from Claim 2, and therefore, for at least the reasons advanced in support of Claim 2, are also believed to be allowable. Additionally, each of these dependent claims is believed to be allowable for reasons further absent the cited art. However, as stated previously, due to the present allowability of these claims no further discussion of these claims is necessary at this time. The Applicants therefore respectfully request that this ground of rejection be withdrawn as to Claims 2-12 and 14-18.

New Claims:

Claims 29-38 are new crafted to cover certain patentable subject matter. In one example, Claim 29 recites "vaporizing a metallic element or metallic element salt in the presence of the heated inert carrier gas, wherein the metallic element or salt is selected from the group consisting of Ca, Sr, Ba, Mn, Cd, CaCl_2 , CaBr_2 , NbCl_5 and ZrCl_4 ". None of the materials or the presently claimed process is covered by any of the cited portions of the provided references. Accordingly, the claims are which is believed to be allowable. Moreover, each and every dependent limitation recited in each new claim is also believed to define additionally over the cited art. None of the dependent limitations is found in the cited references. Accordingly all of these claims are believed to define over the art of record. All of these claims are clearly directed toward ways and uses for the ionized material. No cited art teaches or suggests this. Accordingly, it is respectfully submitted that these claims are allowable over the art of record.

Allowable Subject Matter:

The Examiner has suggested that Claims 1 and 23-28 are believed to be allowable. The Applicants thank the Examiner for the kind indication of allowability as to these claims.

Conclusion:

In view of the foregoing amendments and remarks, it is respectfully submitted that the claimed invention as presently presented is patentable over the art of record and that this case is now in condition for allowance.

Accordingly, the Applicants request withdrawal of all pending rejections and request reconsideration of the pending application and prompt passage to issuance. The Applicants further clarify that any lack of response to any of the issues raised by the Examiner is not an admission by the Applicants as to the accuracy of the Examiner's assertions with respect to such issues. Accordingly, Applicants specifically reserve the right to respond to such issues at a later time during the prosecution of the present application, should such a need arise.

Additionally, if any additional fees are due in connection with the filing of this Amendment, the Commissioner is authorized to deduct such fees from Deposit Account No. 12-2252 (Order No. LSI1P212).

As always, the Examiner is urged to telephone the Applicants' representative to discuss any matters pertaining to this case. Should the Examiner wish to contact the undersigned for any reason, the telephone number set out below can be used.

Respectfully submitted,

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